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6.1 APPROVALS, DISTRIBUTION AND WORK FLOW

Production of Structural Plans

Regional Office	1. Prepare Structure Survey Report.
Geotechnical Section (Bur. of Tech. Services)	2. Make site investigation and prepare Site Investigation Report. See 6.2(1) for exceptions.
Structures Development Sect. (Bur. of Structures)	3. Record Structure Survey Report.
Structures Design Section (Bur. of Structures)	4. Determine type of structure.
	5. Perform hydraulic analysis if required.
	6. Check roadway geometrics and vertical clearance.
	7. Review Site Investigation Report and determine foundation requirements. Check criteria for scour critical Bridges and record scour critical code on the preliminary plans.
	8. Draft preliminary plan layout of structure.
	9. Send copies of preliminary plans to Regional Office.
	10. If a railroad is involved, send copies of preliminary plans to the Rails & Harbors Section (Bureau of Transit, Local Roads, Rails & Harbors) who will forward details and information to the railroad company.
	11. If Federal aid funding is involved, send copies of preliminary plans to the Federal Highway Administration for major, moveable, and unusual bridges.
	12. If a navigable waterway is crossed, a Permit drawing to construct the bridge is sent to the Coast Guard. If FHWA determines that a Coast Guard permit is needed, send a Permit drawing to the Coast Guard. If Federal aid is involved, preliminary plans are sent to the Federal Highway Administration for approval.

	13.	Review Regional Office comments and other agency comments, modify preliminary plans as necessary.
	14.	Review and record project for final structural plan preparation.
	15.	Assign project to a Structures Design Unit.
Structures Design Units (Bur. of Structures)	16.	Prior to starting project, Designer contacts Regional Office to verify preliminary structure geometry, alignment, width and the presence of utilities.
	17.	Prepare and complete design and final plans for the specified structure.
	18.	Give completed job to Manager of Structures Design Section.
Manager, Structures Design Section (Bur. of Structures)	19.	Review final structural plans.
	20.	Review and revise or write special provisions as needed.
	21.	Send copies of final structural plans and special provisions to Regional Offices.
	22.	If a railroad is involved, send copies of final plans to the Rails & Harbors Section.
	23.	Sign lead structural plan sheet.
	24.	Deliver final structural plans and special provisions to the Bureau of Project Development.
Bur. of Project Development	25.	Prepare final approved structural plans for pre-contract administration.

A map of navigable waterways in Wisconsin as defined by the Coast Guard is kept in the Preliminary Structures and Hydraulics Unit (Bureau of Structures).

6.2 PRELIMINARY PLANS

(1) Structure Survey Report

The Structure Survey Report is prepared by Regional Office personnel to request a structure improvement project. The following forms in word format are used and are available at: http://www.dot.wisconsin.gov/forms/index.htm

Under the **"Plans and Projects"** heading:

DT1694 - English-Separation Structure Survey Report
DT1696 - English Rehabilitation Structure Survey Report
DT1698 - English-Stream Crossing Structure Survey Report (use for Culverts also)

The front of the form lists the supplemental information to be included with the report. Duplicate reports and supplemental information are required for Federal aid primary and Interstate projects.

When preparing the Structure Survey Report, designers will make their best estimate of structure type and location of substructure units. The completed Structure Survey Report with the locations of the substructure units and all required attachments and supporting information will then be submitted to the Geotechnical Section, attention Chief Geotechnical Engineer, through the Regional Soils Engineer, and to the Preliminary Structures & Hydraulics Unit, attention Preliminary Structures & Hydraulics Supervisor. This submittal will take place a minimum of 15 months in advance of the final plans due date shown on the Structure Survey Report. Under this plan, the box on the Structure Survey Report titled, "Have soil borings been requested" should always be checked "yes". The Geotechnical Section has responsibility for conducting the necessary soil borings. The Preliminary Structures and Hydraulics Unit and the Geotechnical Section will coordinate activities to deliver the completed preliminary plans on schedule.

In most instances, the geotechnical work will proceed after the receipt of the Structure Survey Report, but in advance of the development of the preliminary bridge plans. However, special circumstances may require that the preliminary bridge plans precede the geotechnical work. The Geotechnical Section may request preliminary bridge plans under the following conditions.

1. A review of available subsurface information indicates the probability of very shallow and highly variable bedrock.
2. The span on the Structure Survey Report falls in the 30 to 40 (9 to 12 meter) range and the decision between a bridge or a box culvert is not evident.

3. The Structure Survey Report indicates a multiple span structure in excess of 100 feet (30 meters) over a body of water.

The Project Manager may also request information on structure type and substructure locations if such information is necessary to expedite the environmental process.

Under this process, the scheduling of geotechnical work is coordinated with the Preliminary Structures & Hydraulics Unit toward completion of the bridge plans by the final plan due date. If other geotechnical work is required for the project, the designer should coordinate with the Regional Soils Engineer and the Geotechnical Section to promote efficiency of field drilling operations.

If the preliminary bridge plans are required more than one year in advance of the final plan due date on the Structure Survey Report due to the unique needs of the project, the project manager should discuss this situation with the Preliminary Structures & Hydraulics Supervisor prior to submitting the Structure Survey Report. A note discussing the agreed upon schedule should then be attached to all copies of the Structure Survey Report so all parties are aware of the schedule. The Geotechnical Section is responsible for scheduling the borings.

Coordination early in the design process with DNR regarding removal techniques for the existing structure, and new structure placement and type is very important. The status of any agreements with the DNR, that affect the structure should be noted under additional information on the Structure Survey Report.

Following is a sample of a Stream Crossing Structure Survey report.

(2) Preliminary Layout

A. General. The preparation of a preliminary layout for structures is primarily for the purpose of presenting an exhibit to the agencies involved for approval, before proceeding with final design and preparation of detail plans. When all the required approvals are obtained, the preliminary layout is used as a guide for final design and plan preparation.

For box culverts a preliminary drawing is usually not prepared. Information required to be submitted as a part of the survey report for a box culvert is usually sufficient to serve as a preliminary layout.

The drawings for preliminary layouts are on sheets having an overall width of 11 inches and an overall length of 17 inches.

ENGLISH - STREAM CROSSING STRUCTURE SURVEY REPORT

Wisconsin Department of Transportation

DT1698 1/2006 (Replaces EB53)

☐ Box Culvert ☐ Culvert Extension ☐ Right ☐ Left ☒ Stream Crossing ☐ Other

Final Plan Due Date	Preliminary Plan Due Date (N/A for Culverts)	☒ Town of Winchester ☐ Village of ☐ City of	
3/1/1999	10/1/1998		
New Structure Number: B-70-139	Highway: STH 110	County: Winnebago	Design Project ID: 6200-06-00
Aesthetics Level (For Levels 2, 3 & 4, Explain on Page 4): ☐ 1 ☒ 2 ☐ 3 ☐ 4			Construction Project ID: 6200-06-71
Station: 303 + 00	Section: 35/36	Town: 20N	Range: 15E
Indicate Purpose: ☒ Waterway ☐ Other (Describe)		Identify Stream (If Applicable): Arrowhead River	
Region Contact Person/Area Code with Telephone Number: D. Pauli 414-926-5672		Traffic Forecast Data	
Consultant Contact Person/Area Code with Telephone Number		Design Year: 2015	Average Daily Traffic (ADT): 9150
		Roadway Design Speed: 100 mph	Functional Class:

Instructions for Structure Survey

In addition to this report, the following information shall be submitted.

1. **Small County Map** on which the location of proposed structure is shown in red and highway relocation, if any, in green.
2. **Plan and Profile Sheet** on proposed reference line of highway showing the following: (a) Ground line; (b) Finished grade line; (c) Profile grade line elevations at least every 100 feet for 1,000 feet each side of the structure; (d) Vertical curve control points; (e) Horizontal curve control points; (f) Curve data, including full SE and runoff distance.
3. **Contour Map** of the site drawn to a scale of not less than 1" = 20 feet with one-foot contours and showing the following (a) Existing highway and structure; (b) Proposed highway alignment and R/W; (c) Station numbers; (d) North arrow; (e) Buildings; (f) Underground facilities; (g) Other features which influence the design; (h) Recommended channel change; (i) Direction of stream flow; (j) Stations at end of existing structure; (k) Proposed structure and extent of riprap for consultant designed structures.
4. **Typical Roadway Cross Section** of proposed approaches showing the following: (a) Dimensions; (b) Slopes; (c) Type and width of surfacing or pavement; (d) Sidewalk, curb and gutter; (e) Subgrade and pavement thickness; (f) Clear zone width.
5. **Stream Cross Section** at upstream and downstream face of existing bridge and at one bridge length upstream and downstream. Surface water elevations at 1500 feet upstream and downstream of existing bridge.
6. **Original Photographs** of: (a) Existing structure; (b) Upstream and downstream structures; (c) Buildings within 100 feet of the proposed structure; (d) Unobstructed panoramic view looking upstream and downstream from proposed structure. *Air photo mosaics if available.*
7. **Proposed Location Map** showing structure location and number, one per structure when there are multiple structures on the project.
8. Attach a copy of the regulatory flood plain map (FEMA map) depicting the site.
9. For consultant designed structures - **Hydraulic Report** which may contain the following: (a) USGS quadrangle sheet showing proposed location, highway alignment and reach of river; (b) All available flood history, high water marks with date of occurrence, nature of flooding, damages and scour information; (c) Factors affecting water stages; (d) Navigation Clearance, for guidance in making report, see Chapter 8 of Bridge Design Manual; (e) Discussion of alternatives considered, factors influencing selection.
10. Attach a copy of DNR initial concurrence letter.

Proposed Structure

Preference for Structure Type at this Site Prestressed Girder	☐ Check here if to be determined by Central Office
Roadway Width Between Curbs 40 Ft.	Cross Slope on Deck or N.C. (Normal Crown) Ft./Ft.
Sidewalks – Number 1	Sidewalk Clear Width 5.0 Ft.
Specify Wing Location for Beam Guard Attachment All 4 Wings	Specify Clear Zone Width when Beam Guard not Used on Culvert
Specify Wing Location for Surface Drain Anchors NE & NW	Specify Wing Location where Bridge Barrier/Rail Continues on Roadway Approach

YES	NO		YES	NO	
☒	☐	Is Project in Flood Hazard Area	☒	☐	Structure Backfill Required
☒	☐	Have Soil Borings been Requested (If not, Please Explain on Page 4)	☒	☐	Riprap Required
☐	☒	Staged Construction	☐	☒	Lighting Required on Bridge Bolt Circle Diameter _____ inches
☐	☒	Temporary Structure Required	☐	☐	Camber for Barrel Recommended (Culvert only)
			☐	☐	Is this project on the National Highway System

Proposed Disposition of Existing Structure

YES	NO		Level of Removal	
☒	☐	Structure will be Removed	☐	Normal Removal
☒	☐	Bid item will be included in Structure Plan Quantities	☐	Removal with Minimal Debris
☐	☒	Structure will remain in Service - Structure #	☐	Removal with Capture System

☐ Special Foundation Treatment Required - See Soils Unit "Site Investigation Report"

If utilities will be carried on the structure, complete the following data.

Type	Size	Opening Size at Abutments	Weight	Pressure
Gas	4" ϕ	6" Square	60#/Ft.	75 psi

For Structure Designers Use
Proposed Box Culvert

Aprons	Type	Elevations
Inlet		
Outlet		

Openings - Number	Clear Span at Right Angles to Axis of Box	Inside Height of Box
Slope of Channel at Culvert		

All Proposed Structures

Spans - Number	Spans Lengths (C.L. to C.L. of Substructure)	Skew ☐ R.H.F. ☐ L.H.F.

Drainage Area _____ Sq. Mi.
High Water (100) _____ Ft.
Velocity _____ Ft/Sec.
Waterway Area _____ Sq. Ft.
Scour Code _____

Q (100) _____ cfs
Q (Struct.) _____ cfs
Q (Rdwy.) _____ cfs
Q (Suple. Struct.) _____ cfs

Existing Bridge
High Water (100) _____ Ft.
Regulatory High Water
_____ Ft.

Erosion Control
Q_2 = _____ cfs.
HW_2 = _____ Ft.

Temporary Structure
Q _____ Yr. _____ cfs.
High Water _____ Ft.
Min. A (BR) _____ Sq. Ft.

Overtopping Frequency (If>100Yrs.-NA)
Q _____ Yr. _____ cfs.
High Water _____ Ft.

Existing Structures At or Near Proposed Site

STRUCTURE DATA		UPSTREAM	AT SITE	DOWNSTREAM
Structure Number (B / P / C)		None	B-70-904	B-70-121
Railroad or Highway Structure			STH 110	Woodland Rd
Distance from Proposed Site in Miles				1.29
Type:	Superstructure		Concrete	Concrete
	Substructure: Abutments		Concrete	Concrete
	Piers		None	Pile Encased
Is Structure Supported on Bearing Piles?			Unknown	
Condition:	Superstructure		Poor	
	Substructure		Poor	
Year Built			1926	1990
Number of Spans			1	2
Clear Span (Between Inside Faces of Substructure Units) Lengths Along CL Roadway/Track			40 Ft.	28 & 28
Roadway Width Between Curbs			28 Ft.	27
Sidewalk:	Number		None	
	Clear Width			
	Location			
Skew:	Stream		35°	None
	Structure		0°	0°
* Elevation	Finished Grade		758.1 Ft.	753.5
+ +	Low Chord		753.1 Ft.	751.8
Does Drift Pass Satisfactorily			Yes	Yes
Does Ice Pass Satisfactorily			Yes	Yes
Character of Material in Stream Bed			Silt	Silt
**	Character of Drainage Basin			
Stream-Bed Scour:	Visable (Y/N)		Y	N
	Due to Restricted Waterway		N	-
	Due to Poor Location		N	-
	Due to Improper Skew		Y	-
Extreme High Water Elevation - Date			753.7 Ft.	753.6
Cause of High Water and Source of Information			Thaw & Runoff	Runoff
Low Water Elevation			751.3	
Observed Water Elevation				
Streambed Elevation			750.8	750.6

Water Surface Elevation ***	Date	1500' Upstream	At Site	1500' Downstream

Existing Culvert Information

Attach Sketch
Slope of Channel at Structure (ft./100 ft.)
Elevation: Finished Grade _____
Inlet - Invert _____
- Top of Opening _____
Discharge - Invert _____
- Top of Opening _____

Spans: Number _____
Width Normal - Barrel _____
Allowable High Water _____
Floor: Concrete, Earth, Silted _____
Condition: Wingwalls _____
Barrel _____

* Use same datum for all structures within one-half mile of proposed structure.
** Mountains, Hilly, Rolling, Flat, Swampy, Wooded, Cultivated, Pasture, etc. - Give percentage of each.
*** Measured along thread of channel.
+ + Take these elevations at the same station.

Additional Information

Elaborate on other concerns such as: DNR, Local, Aesthetics and Stage Construction

Scour at banks does not seem to be a problem, although riprap at wings could be recommended. There is no riprap at existing structure.

DNR has no special concerns.

Level 2 Aesthetics – Structure is located in residential area within a park area. Provide texture on wing walls and piers and provide a brown coloring. Use an aesthetic railing.

FOR BRIDGE OFFICE USE

Plans Checked By Date

B. Basic Considerations. The following criteria are used for the preparation of preliminary plans.

1. Selection of Structure Type. Refer to Chapter 17, Superstructure-General, for a discussion of structure types.

2. Span Arrangements. For stream crossings the desired minimum vertical clearance from high water to low steel is given in Chapter 8.0-Hydraulics. Span lengths for multiple span stream crossings are in most cases a matter of economics and the provision for an opening that adequately passes ice and debris. For structures over navigable streams, the vertical and horizontal clearance of the navigable span are determined by the U.S. Coast Guard after considering the interests of both highway and waterway transportation users.

   For most of the ordinary grade separation structures the requirements for horizontal clearance determine the span arrangements. Refer to Chapter 17.0-Superstructure-General for span length criteria.

3. Economics. Economy is a primary consideration in determining the type of structure to be used. Refer to Chapter 5.0-Economics and Costs, for cost data.

   At some stream crossings where the grade line permits considerable head room, investigate the economy of a concrete box culvert versus a bridge type structure. When economy is not a factor, the box culvert is the preferred type from the standpoint of maintenance costs, highway safety, flexibility for roadway construction, and provision of a facility without roadway width restrictions.

4. Aesthetics. Recognition of aesthetics as an integral part of a structure is essential if bridges are to be designed in harmony with adjacent land use and development. Refer to Chapter 4.0-Aesthetics.

5. Hydraulic Consideration. Stream crossing structures are influenced by stream flow, drift, scour, channel conditions, ice, navigation, and conservation requirements. This information is submitted as part of the Structure Survey Report. Refer to Chapter 8 for Hydraulic considerations and Section 8.1(5) for Temporary Structure Criteria.

6. Geometrics of Design. The vertical and horizontal clearance roadway widths, design live loading, alignment, and other pertinent geometric requirements are given in Chapter 3.

7. Maintenance. All bridge types require structural maintenance during their service life. Maintenance of approaches, embankments, drainage, substructure, concrete deck, and minor facilities is the same for the various types of bridges. A minimum draining grade of 0.5% across the bridge is desirable to eliminate small ponds on the deck except for open railings where the cross slope is adequate.

   Epoxy coated bar steel is required in all new decks and slabs.

   Steel girders require periodic painting unless a type of weathering steel is used. Even this steel may require painting near the joints. It is more difficult to repaint steel girders that span busy highways.

   Reinforced concrete box girders and voided slabs have a poor experience in Wisconsin. They should not be used on new structures.

   Deck expansion joints have proved to be a source of maintenance problems. Bridges designed with a limited number of watertight expansion devices are recommended.

8. Construction. Occasionally a structure is proposed over an existing highway on which traffic must be maintained. If the roadway underneath carries high volumes of traffic, any obstruction such as falsework would be hazardous as well as placing undesirable vertical clearance restrictions on the traveled way. This is also true for structures over a railroad.

   For structures over most high-volume roadways construction time, future maintenance requirements, and provision for future expansion of the roadway width, have considerable influence on the selection of the final product.

9. Foundations. Poor foundation conditions may influence the structure geometry. It may be more economical to use longer spans and fewer substructure units or a longer structure to avoid high approach fills.

10. Environmental Considerations. In addition to the criteria listed above all highway structures must blend with the existing site conditions in a manner that is not detrimental to environmental

factors. Preservation of fish and wildlife, pollution of waters, and the effects on surrounding property are of primary concern in protecting the environment. The design of structures and the treatment of embankments must consider these factors.

11. Safety. Safety is a prime consideration for all aspects of the structure design and layout. Bridge railings are approved through actual vehicle crash testing.

C. Requirements of Drawing

1. Plan View. The plan view is preferably placed in the upper left-hand portion of the sheet at the largest scale practical (1"=10') and shows the following basic information:

a. Structure span lengths, (center-to-center of piers and to centerline of bearing at abutments, end distance from centerline of bearing to back face of abutment and overall length of structure).

b. Dimensions along the reference line except for structures on a curve in which case they are along a tangent to the curve.

c. Stations are required at centerline of piers, centerline of bearing at abutments, and end of deck or slab.

d. Stations at intersection with reference line of roadway underneath for grade separation structures.

e. Direction of stationing increase for highway or railroad beneath a structure.

f. Detail the extent of slope paving or riprap.

g. Direction of stream flow and name if a stream crossing.

h. Highway number and direction and number of traffic lanes.

i. Horizontal clearance dimensions, pavement, shoulder, sidewalk, and structure roadway widths.

j. Median width if dual highway.

k. Skew angles and angles of intersection with other highways, streets or railroads.

l. Horizontal curve data if within the limits of the structure showing station of PC, PT, and PI.

m. Location of and vertical clearance at point of critical vertical clearance if highway or railroad separation. (For both roadway directions on divided highways).

n. If floor drains are proposed the type, approximate spacing, and whether downspouts are to be used.

o. Existing structure description and number, buildings, underground utilities and pole lines giving owner's name and whether to remain in place, be relocated or abandoned. Show a tie dimension between old and new work.

p. Indicate which wingwalls have beam guard rail attached if any and wing lengths.

q. Structure numbers on plan. North Arrow.

r. Excavation protection for railroads.

s. Location of deck lighting or utilities if any.

t. Name Plate location.

u. Locations of surface drains on approach pavement.

2. Elevation View. The elevation view is preferably placed below the plan view. If the structure is not skewed the substructure units are to be a straight projection from the plan view. If skewed, the elevation is a view normal to substructure units. The view shows the following basic information:

a. Profile of existing groundline or streambed.

b. Cross-section of highway or channel below showing back slopes at abutments.

c. Elevation of top of berm and rate of back slope used in figuring length of structure.

d. Type and extent of slope paving or riprap on back slopes.

e. Proposed elevations of bottom of footings and type of piling if required.

f. Depth of footings for piers of stream crossing and if a seal is required, show and indicate by a note.

g. Location and amount of minimum vertical clearance.

h. Streambed, observed and high water elevations for stream crossings.

i. Location of underground utilities, with size, kind of material and elevation indicated.

j. Location of fixed and expansion bearings.

k. Location and type of expansion devices.

l. Use a scale of 1" = 10' whenever possible.

2. Cross-Section View. The cross-section view need only be a half section if symmetrical about a reference line, otherwise it is a full section taken normal to reference line. Use a scale of (1" = 4') whenever possible. A view of a typical pier is shown as a part of the cross-section. The view shows the following general information:

a. Slab thickness, curb height and width, type of railing.

b. Horizontal dimensions tied into a reference line or centerline of roadway.

c. Steel beam or girder spacing with beam/girder depth.

d. For prestressed girders approximate position of exterior girders.

e. Direction and amount of crown or superelevation.

f. Point referred to on profile grade.

g. Type of pier with size and number of columns proposed.

h. For solid, hammerhead or other type pier approximate size to scale.

i. If length of concrete pier cap between outer pier columns exceeds approximately 60 feet (20 meters), provide an opening in the cross girder for temperature changes and

concrete shrinkage, or design the pier cap for temperature and shrinkage to eliminate the opening.

j. Dimension minimum depth of bottom of footings below ditch or finished ground line or if railroad crossing below top of rail.

k. Location for public and private utilities to be carried in the superstructure. Label owner's name of utilities.

l. Location of lighting on the deck or under the deck if any.

4. Other Requirements

a. Profile grade line across structure showing tangent grades and length of vertical curve. Station and elevation of PC, PI, PT, and centerline of all substructure units.

Profile grade line of highway beneath structure if highway separation or of top rail if railroad separation. Stations along top of rail are to be tied into actual stationing as established by railroad company.

b. Complete curve data of all horizontal curves which may influence layout of structure.

c. Channel change section if applicable. Approximate stream bed elevation at low point.

d. Any other view or detail which may influence the bridge type, length or clearance.

e. List design data including Ultimate Stresses for materials:

(1) Concrete Superstructure
(2) Concrete Substructure
(3) Bar Steel Reinforcement
(4) Structural Steel
(5) Prestressed Concrete
(6) Prestressing Steel

Foundations

(1) Soil Bearing Pressure
(2) Pile Type and Capacity

Ratings

(1) Design
(2) Inventory
(3) Operating
(4) Max. Vehicle Weight (250 kips max.)

Hydraulic Data

Base Flood

(1) 100 Year Discharge
(2) Stream Velocity
(3) Highwater Elevation
(4) Q2 Elevation (Based on new structure opening)
(5) Waterway Area
(6) Drainage Area
(7) Scour Critical Code

Overtopping Flood

(1) Overtopping Frequency
(2) Overtopping Elevation
(3) Overtopping Discharge

OR (Overtopping N.A. for Floods Greater Than the 100 Year Flood) .

f. Show traffic data. Give traffic count, data and highway for each highway on grade separation or interchange structure.

D. Utilities

In urban areas, public and private utilities generally have their facilities such as sewers, water cables, pipes, ducts, etc., underground, or at river crossings, in the streambed.

If these facilities cannot be relocated, they may interfere with the most economical span arrangement. The preferred location of light poles is at the abutments or piers.

Overhead power lines may cause construction problems or maintenance inspection problems. Verify if they exist and notify Utilities & Access Management Unit (Bureau of Tech. Services) to have them removed.

It is the general policy to not place utilities on the structure. The Utilities & Access Management Unit approves all utility applications and determines whether utilities are placed on the structures or can be accommodated some other way. Refer all requests to them. Also see Chapter 18 of the FDM and Chapter 4 of "WisDOT Guide to Utility Coordination".

(3) Distribution of Exhibits

A. Federal Highway Administration (FHWA). Preliminary plan exhibits listed below are submitted to the FHWA for their review and comment in accordance with Federal Aid Highway Program Manual, Vol. 6, Chapter 1, Section 2, Subsection 1. In addition to the structures described in the Manual (moveable bridges, unusual bridges, new structure types, major bridges costing more than $10,000,000, major channel changes), FHWA also requests that preliminary structure plans be submitted for all railroad

grade separation structures. Material to be submitted consists of one print or copy of the following:

1. Preliminary drawing.
2. Log of borings.
3. Evaluation report of borings.
4. Survey report for stream crossing structures.
5. Contour map.
6. Typical section of roadway approaches.
7. Plan and profile of approach roadways.
8. Hydraulic report (See Chapter 8.0)
9. County map showing location of new and existing structures.
10. Any other information or drawings which may influence location, layout or design of structure.

B. Coast Guard. Current permit application guides published by the 2nd or 9th Coast Guard District should be followed. For Federal Aid projects, applicants must furnish two copies of the Final Environmental Impact Statement accepted by the lead agency. The Regional Office will also forward Water Quality Certification obtained from the Department of Natural Resources.

C. Regions. One print of all preliminary drawings is sent to the Regional Office involved, for their review. For structures financed partially or wholly by a county, city, village or township, their approval should be obtained by the Regional Office and approval notice forwarded to the Bureau of Structures.

D. Utilities. For all structures which involve a railroad, four prints of the preliminary drawing are submitted to the Utilities & Access Management Unit for submission to the railroad company for approval.

If private or public utilities wish to make application to attach their facilities (water, and sewer mains, ducts, cables, etc.) to the structure, they must apply to the Utilities & Access Management Unit for approval.

E. Other Agencies. One set of preliminary plans (preliminary layout, plan & profile, and contour map) for stream crossing bridges are forwarded to the Department of Natural Resources for comment, in accordance with the cooperative agreement between the Department of Transportation and the Department of Natural Resources. (See Chapter 8.0).

6.3 FINAL PLANS

This section describes the general requirements for the preparation of construction plans for bridges, culverts, retaining walls and other related highway structures. It provides a standard procedure, form, and arrangement of the plans for uniformity.

(1) General Requirements

A. Drawing Size. Sheets are 11 inches wide from top to bottom and 17 inches long. A border line is provided on the sheet 1 inch from the left edge, and ¼ inch from other edges. Title blocks are provided on the first sheet for a signature and other required information. The follow sheets contain the same information without provision for a signature.

B. Scale. All drawings insofar as possible are drawn to scale. Such details as reinforcing steel, steel plate thicknesses, etc. are not scaled. The scale is adequate to show all necessary details.

C. Line Thickness. Object lines are the widest line on the drawing. Lines showing all or part of an existing structure or facility are shown by dotted lines of somewhat lighter weight.

Lines showing bar steel are lighter than object lines and are drawn continuous without any break. Dimension and extension lines are lighter than bar steel lines but heavy enough to make a good reproduction.

D. Lettering and Dimensions. All lettering is upper case. Lettering and dimensions are read from the bottom or right hand side and should be placed above the dimension lines. Notes and dimension text are 0.12 inches high; view titles are 0.20 inches high (based on full size sheet, 22" x 34"). Dimensions are given in feet and inches (millimeters). Elevations are given in decimal form to the nearest 0.01 of a foot (0.001 of a meter). Always show two (three) decimal places. Although plan dimensions are very accurate, the contractor should use reasonable tolerances during construction of the project by building to the accuracy required. Detail structural steel to the thickness of the material involved.

E. Notes. Show any notes to make the required details clear on the plans. Do not include material that is part of the specifications.

F. Standard Insert Drawings. Standard detail sheets are available for railings and parapets, prestressed girders, bearings, expansion joints, and drains. Fill in the dimensions and titles required and insert in the final plans.

Standard insert sheets can be found at:
http://trust.dot.state.wi.us/extntgtwy/dtid_bos/extranet/structures/index.htm

G. Abbreviations. Abbreviations are to be used throughout the plans whenever possible. Abbreviations approved to be used are as follows:

Abutment..... ABUT.
Adjacent..... ADJ.
Alternate..... ALT.
And..... &
Angle (degree)..... Spell Out
Approximate..... APPROX.
At..... @
Back to Back..... B to B
Back Face..... B.F.
Base Line..... B/L
Bench Mark..... B.M.
Bearing..... BRG.
Bituminous..... BIT.
Bridge..... BR.
Cast-in-Place..... C.I.P.
Centers..... CTRS.
Center Line..... C/L
Center to Center... C to C
Channel (stream).. CH
Checkered..... CHK.
Column..... COL.
Compression..... C.
Concrete..... CONC.
Construction..... CONST.
Continuous..... CONT.
Corrugated Metal
Culvert Pipe..... C.M.C.P.
Creosoted..... CREO.
Cross Section..... X-SEC.
Crushed Stone.... CR.ST.
Dead Load..... D.L.
Degree of Curve. D.
Degree..... °
Diaphragm..... DIAPH.
Diameter..... DIA.
Discharge..... DISCH.
Division of
Highways..... DOH
East..... E.
Elevation..... EL.
Estimated..... EST.
Excavation..... EXC.
Expansion..... EXP.
Fixed..... F.
Flange Plate..... Fl. Pl.
Front Face..... F.F.
Galvanized..... GALV.
Gauge..... GA.
Girder..... GIR.
Highway..... HWY.
Horizontal..... HOR.
Impact..... I.
Inclusive..... INCL.
Inlet..... INL.
Intersection Angle.... OR I
Invert..... INV.
Left..... LT.
Left Hand Forward... L.H.F.
Length of Curve..... L.
Live Load..... L.L.
Longitudinal..... LONG.
Maximum..... MAX.
Meter..... m
Millimeter..... mm
Minimum..... MIN.
Miscellaneous..... MISC.
North..... N.
Number..... NO.

Per Cent	%	Section	SEC.
Piece	PC	Sidewalk	SWK.
Plate	PL	South	S.
Point of Curvature	P.C.	Space	SPA.
Point of Intersection	P.I.	Specification	SPEC
Point of Tangency	P.T.	Standard	STD.
Point on Curvature	P.O.C.	Station	STA.
Point on Tangent	P.O.T.	Structural	STR.
Private Entrance	P.E.	Substructure	SUB.
Property Line	P.L.	Superstructure	SUPER.
Quantity	QUAN.	Surface	SURF.
Radius	R.	Superelevation	S.E.
Railroad	R.R.	Symmetrical	SYM
Railway	RY.	Tangent	TAN.
Reference	REF.	Tension	T.
Reinforcement	REINF.	Township	TWP
Reinforced Concrete Culvert Pipe	R.C.C.P.	Transit Line	T/L
Required	REQ'D.	Transverse	TRAN.
Right	RT.	Variable	VAR.
Right Hand Forward	R.H.F.	Vertical	VERT.
Right of Way	R/W	Vertical Curve	V.C.
Roadway	RDWY.	Vitrified	VIT.
Round	ø	Volume	VOL.
		West	W.
		Zinc Gauge	ZN. GA.

H. Nomenclature and Definitions. Universally accepted nomenclature and approved definitions are to be used wherever possible.

(2) Plan Sheets

The following information describes the order of plan sheets and the material required on each sheet.

Plan sheets are placed in order of construction generally as follows:

1. General Plan
2. Subsurface Exploration
3. Abutments
4. Piers
5. Superstructure and Superstructure Details
6. Railing and Parapet Details

Show all views looking up station. Locate the structure name plate on the roadway side of the first right wing traveling in the highway cardinal directions of North or East.

A. General Plan (Sheet 1)

1. Plan View

Same requirements as specified for preliminary drawing, except do not show contours of groundline and as noted below.

a. Sufficient dimensions to layout structure in the field.
b. Describe the structure with a simple note such as: Four span continuous steel girder structure.
c. Give the location of the name plate.
d. Station at face of paving notch on each end of bridge.

2. On Structure Replacements

Show existing structure in dashed-lines on Plan View. Also, provide the existing structure type in the General Notes.

3. Elevation View

Same requirements as specified for preliminary plan except:

a. Show elevation at bottom of all substructure units.
b. Give estimated pile lengths where used.

4. Cross-Section View

Same requirements as specified for preliminary plan except:

a. For railroad bridges show a railroad cross-section.
b. View of pier may or may not be shown.

5. Grade Line

Same requirements as specified for preliminary plan.

6. Design and Traffic Data

Same requirements as specified for preliminary plan plus show Design Specifications as: AASHTO STD. 2003.

7. Estimated Quantities

a. Enter bid item numbers, bid items and quantities as they appear, and in the order in which they appear in the "Schedule of Bid Items" of the Standard Specifications. Put items not provided for at the bottom of the list. Enter quantities for each part of the structure, (superstructure, each abutment, each pier) under a separate column with a grand total.

Quantities are to be bid under items for the Structure Type and not by the "B" or "C" numbers. For example, concrete for a multi-cell box culvert exceeding a total length of 20 feet (6.1 m) is to be bid under item Concrete Masonry Culverts. As another example, a bridge having a length less than 20 feet would be given a "C" number; however, the concrete bid item is Concrete Masonry Bridges.

b. For incidental items to be furnished for which there is no bid item, and compensation is not covered by the Standard Specifications or Special Provisions, note on the plans the most closely related bid item that is to include the cost in the price bid per unit of item. As an example, the cost of concrete inserts is to be included in the price bid per cubic yard (meter) of concrete masonry.

8. General Notes

A standard list of notes is given in Sections 6.3(2)A(a) and 6.3(2)A(b). Use the notes in this table that apply to the structure drawn on the plans.

9. List of Drawings

Each sheet is numbered sequentially beginning with 1 for the first sheet. Give the sheet number and title of sheet.

10. Bench Marks

Give the location, description and elevation of the nearest bench mark.

11. Title Block

Fill in all data for the Title Block except the signature. The title of this sheet is "General Plan". Use the line below the structure number to describe the type of crossing. (Example: STH 15 SB over Fox River). For Design Spec. use AASHTO and year. If LRFD specs. are used, use AASHTO LRFD and year.

12. Professional Seal

All final bridge plans prepared by Consultants or Governmental Agencies shall be professionally sealed, signed, and dated on the general plan sheet. This is not required for WisDOT prepared plans, as they are covered elsewhere.

(a) Plan notes for New Bridge Construction

1. Drawings shall not be scaled. Bar Steel Reinforcement shall be embedded 2” (50 mm) clear unless otherwise shown or noted.

2. All field connections shall be made with 3/4” (M20) diameter friction type high-tensile strength bolts unless shown or noted otherwise.

3. All dimensions are in inches unless otherwise noted.

4. Slab falsework shall be supported on piles or the substructure unless an alternate method is approved by the Engineer.

5. All stations and all elevations are in feet (meters).

6. All reinforcing bars are English (metric) and the first two digits of the bar mark signify the bar size.

7. The slope of the fill in front of the abutments shall be covered with heavy riprap and geotextile fabric to the extent shown on this sheet and in the abutment details.

8. The slope of the fill in front of the abutments shall be covered with slope paving to the extent shown on this sheet and in the abutment details.

9. The stream bed in front of the abutment shall be covered with riprap as shown on this sheet and in the abutment details.

10. The existing stream bed shall be the upper limits of excavation at the piers.

11. The existing groundline shall be the upper limits of excavation for structures.

12. The finished graded section shall be the upper limits of excavation for structures.

13. The upper limits of excavation for structures for the abutments shall be the bottom of slope protection.

14. Pile splices at piers, involving bending, shall be made by a certified welder.

15. Within the length of the box all spaces excavated and not occupied by the new structure shall be backfilled with

Structure Backfill to the elevation and section existing prior to excavation within the length of the culvert.

16. At abutments all spaces excavated and not occupied by the new structure shall be backfilled with granular backfill.

17. Concrete inserts to be furnished by the utility company and placed by the contractor. Cost of placing inserts shall be included in the bid price for concrete masonry.

18. Prestressed Girder Bridges - The minimum concrete haunch shall be 2" (50 mm) for design calculations and the haunch concrete quantity is based on an average haunch depth of 2 1/2" (60 mm) which is the maximum haunch quantity for which the Contractor will be paid.

(b) Plan Notes for Bridge Rehabilitation

1. Dimensions shown are based on the original structure plans.

2. All concrete removal not covered with a concrete overlay shall be defined by a 1 inch (25 mm) deep saw cut.

3. Utilize existing bar steel reinforcement where shown and extend 24 bar diameters into new work.

4. Concrete expansion bolts and inserts to be furnished and placed by the contractor under the bid price for concrete masonry.

5. At "Curb Repair" expose existing reinforcement a minimum of 1 1/2” (40 mm) clear.

6. Existing floor drains to remain in place. Remove top of deck in drain area as directed by the Field Engineer to allow placing and sloping of 1 1/2” (40 mm) concrete overlay.

7. Expansion joint assembly, including anchor studs and hardware shall be paid for in the lump sum price bid as "Expansion Device B-_____” or “Expansion Device Modular B- _____”.

8. Clean and fill existing longitudinal and transverse cracks with penetrating epoxy as directed by the Field Engineer.

9. Variations to the new grade line over 1/4” (5 mm) must be submitted by the Field Engineer to the Structures Design Section for review.

10. If new name plate is required, original construction year is _____.

B. Subsurface Exploration

This sheet is initiated by the Geotechnical Engineer. The following information is required on the sheet. Bridge details are not drawn by the Geotechnical Engineer.

1. Plan View

Show a plan layout of structure with survey lines, reference lines, pier and abutment locations and location of borings and probings plotted to scale.

On box culvert structure plans, show three profile lines of the existing ground elevations (along the centerline and outer walls of the box). Scale the information for these lines from the site contour map that is a part of the structure survey report.

2. Elevation

a. Show a centerline profile of existing ground elevation.

b. Give a simple bridge elevation view showing footing elevations, test pile lengths drawn to scale, general outline of structure, and finished profile lines. Also show the service pile lengths.

c. Show the kind of material, its located depth, and the blow count of the split spoon sampler for each boring. Give the blow count at about 5 foot (2 meter) intervals or where there is a significant change in material.

C. Abutments

Use as many sheets as necessary to show details clearly. Show all bar steel required using standard notations; solid lines lengthwise and solid dots in cross section. "Give dimensions for a skewed abutment to a reference line which passes through the intersection for the longitudinal structural reference line and centerline of bearing of the abutment. Give the dimension, from centerline of bearing to backface of abutment along the longitudinal reference line and the offset distance if on a skew. This is for Regions who prefer the working point at backface of the abutment. Show the skew angle.

*If there is piling, show a complete footing layout giving piling dimensions tied to the reference line. Number all the piles. Give the type of piling, length and minimum bearing value. Show a welded field splice for cast in place concrete or steel H piles.

* For Type A1 and A3 abutments.

Bridge seats for steel bearings are level within the limits of the bearing plate. Slope the bearing area of prestressed girders without steel bearings if the edges of the bearing area differ in elevation by 1/4" (5 mm) or more. Slope the bridge seat between bearings 1" (25 mm) from front face of parapet to front face of abutment. Give all bearing elevations.

1. Plan View

   a. Place a keyed construction joint near the center of the abutment if the length of the body wall exceeds 50 feet (15 m). Make the keyway as large as feasible and extend the horizontal bar steel through the joint.

   b. Dimension wings in a direction parallel and perpendicular to the wing centerline.

   c. Dimension angle between wing and body if that angle is different from the skew angle of the abutment.

2. Elevation

   a. Use steel shims under steel bearings if the difference in elevations between adjacent girders is less than 1/2" (10 mm). If greater, step the bearing areas.

   b. Give beam seat, wing (front face and wing tip), and footing elevations to the nearest .01 of a foot (.001 of a meter).

   c. Give vertical dimension of wing.

3. Wing Elevation

4. Body Section

   Place an optional keyed construction joint in the parapet at the bridge seat elevation if there is a parapet.

5. Wing Sections

6. Bar Steel Listing and Detail

7. List of Quantities

   a. Concrete Masonry - Includes parapet
   b. Reinforcing Steel
   c. Piling - Delivered and Driven
   d. 2 Ply Membrane Waterproofing
   e. Filler - Size only required

f. Pipe Underdrain

Use the following views where necessary:

8. Pile Plan & Splice Detail

9. View Showing Limits of Excavation and Backfill

10. Special Details for Utilities

11. Drainage Details

D. Piers

Use as many sheets as necessary to show all details clearly. One sheet may show several piers if only the height, elevations and other minor details are different.

Give dimensions for a skewed pier to a reference line which passes through the intersection of the longitudinal structural reference line and the pier centerline. Show the skew angle. Dimension the centerline spacing of superstructure girders.

1. Plan View

Show dimensions, footings, cap steps, beam spacings, skew angle, and shims if used.

2. Elevation

Show dimensions and elevations. Show lengths of all columns for clarity. Give the elevation of the bottom of footings and beam seats. Refer to abutments for detailing bridge seats. Dimension all bar steel and stirrups.

3. Footing Plan

Show dimensions for pile spacing, pile numbers and reinforcing steel in footing.

4. List of Quantities (Give for each pier separately)

a. Concrete Masonry
b. Reinforcing Steel
c. Piling - Delivered and Driven
d. Test Piling - Timber only
e. Cofferdam - Required if a seal is shown on plans.

5. Bar Steel Listing and Details

6. Pile Splice Detail (If different from abutment only).

7. Cross Section thru Column and Pier Cap

Detail anchor bolts between reinforcing bars so minimum clearance is as shown on Standard 13.1. Long steel bridges may require more clearance. This allows an erection tolerance for the structural steel so that the bar steel is not pierced by the anchor bolts if the bearing is shifted.

E. Superstructure

Use as many sheets as are necessary to show all details clearly. Standard insert sheets are available to show many standard details. The title, project number, and a few basic dimensions are added to these standard sheets.

1. All Structures

a. Show the cross-section of roadway, plan view and related details, elevation of typical girder or girders, details of girders, and other details not shown on standard insert sheets. Complex bearings and expansion joint details are not shown on standard insert sheets. All drawings are to be fully dimensioned and show such sections and views as needed to detail the superstructure completely.

b. Show the total dead load deflections at 0.1 points of each span. Give deflections to nearest 1/8” (5 mm).

c. Show a table of elevations of the top of slab at 0.1 points of the spans. Show the top of slab elevations at the outside edge of slab. For steel girders show in the table the top of girder steel elevation after erection at each field splice and centerline of all bearings.

d. Show a pouring diagram for all slabs which have a concrete volume that exceeds 250 cubic yards(230 cubic meters). See standard for location of construction joints.

e. Provide a paving notch at each end of all structures for rigid approach pavements. See standard for details.

f. If the structure contains conduit for a deck lighting system, place the conduit in the concrete parapet. Place expansion devices on conduit which passes through structure expansion joints. For conduit that passes through deflection joints paint the conduit with a heavy coat of bituminous paint 20” (500 mm) on each side of joint. Detail openings in bulkheads and give some flexibility to contractor.

g. Show the bar steel reinforcement in the slab, curb, and sidewalk with the transverse spacing and all bars labeled. Show the direction and amount of roadway crown.

h. On bridges with a median curb and left turn lane, water may be trapped at the curb due to the grade slope and crown slope. If this is the case, make the cross slope flat to minimize the problem. Existing pavers cannot adjust to a variable crown line.

i. On structures with modular joints consider cover plates for the back of parapets when aesthetics are a consideration.

2. Steel Structures

a. Show the diaphragm connections on steel girders. Show the spacing of rail posts on the plan view.

b. Show a steel framing plan for all steel girders. Show the spacing of diaphragms.

c. On the elevation view of steel girders show dimension, material required, field and shop splice locations, stiffener spacings, shear connector spacing, and any other information necessary to construct the girder. In additional views show the field splice details and any other detail that is necessary.

d. Show the size and location of all weld types with the proper symbols except for butt welds. Requirements for butt welds are covered by A.W.S. Specifications.

e. Show a blocking diagram with the required camber for all continuous steel girder bridges. Blocking dimensions are required at all bearings, field splice points, and shop splice points where there is a change in direction or slope of the girder. Give all dimensions from a horizontal line passing through the low end of the girder at centerline of bearing.

f. Slabs of uniform thickness are used on steel girders. Variations in thickness are achieved by haunching the slab over each girder. Haunches are formed off the top of the top flange. See the standard for details. In general the minimum haunch depth along the girder is to be 1 1/4” (30 mm) although 2” is recommended to allow for construction tolerances. This is generally achieved by setting haunch depths of 2” (50 mm) at field splices and end bearings. Haunch depth is the distance from the bottom of the concrete slab to the top of the top flange. Use of girder haunches eliminates some girder cambering.

g. Existing flange and web sizes should be shown to facilitate the sizing of bolts on Rehabilitation Plans.

F. Railing and Parapet Details

Standard drawings are maintained by the Structures Development Section showing railing and parapet details. Add the details and dimensions to these drawings that are unique to the structure being detailed. Compute the length along the slope of grade line rather than the horizontal dimension.

(3) Miscellaneous Information

A. Bill of Bars

Show a complete bill of bar steel reinforcement for each unit of the structure. Place this bill on the sheet to which the bars pertain. If the abutments or piers are similar, only one bar list is needed for each type of unit.

Give each bar or group of bars a different mark if they vary in size, length, or location in a unit. Each bar list is to show the mark, number of bars, length, location and detail for each bar. Give bar lengths to the nearest 1" (50 mm) and segment lengths of bent bars to the nearest 1/2" (10 mm). Show all bar bends and hooks in detail.

Identify all bars with a letter indicating the unit in which the bar is placed - A for abutment, P for pier, S for superstructure. Where units are multiple, each unit should have a different letter. Next use a one or two digit number to sequentially number the bars in a unit. P1008 indicates bar number 08 is a size number 10 bar located in a Pier.

Use a Bar Series Table where a number of bars the same size and spacing vary in length is a uniform progression. Use only one mark for all these bars and put the average length in the table.

Refer to the Standard drawings in Chapter 9.0 for more information on reinforcing bars such as minimum bend diameter, splice lengths, bar supports, etc.

When a bridge is constructed in stages, show the bar quantities for each stage. This helps the contractor with storage and retrieval during construction.

B. Box Culverts

Detail plans for box culverts are to be fully dimensioned and have sectional drawings needed to detail the structure completely. The following items are to be shown when necessary:

1. Plan View
2. Longitudinal section
3. Section thru box
4. Wing elevations
5. Section thru wings
6. Section thru cutoff wall
7. Vertical construction joint
8. Bar steel clearance details
9. Header details
10. North point, Bench mark, Quantities
11. Bill of bars, Bar details
12. General notes, List of drawings, Rip rap layout
13. Inlet nose detail on multiple cell boxes
14. Corner details

Bid items are excavation, concrete masonry, bar steel and rip rap. Non bid items are membrane waterproofing, filler and expansion bolts. In lieu of showing a contour map, show profile grade lines as described for Subsurface Exploration sheet.

See the standard details for box culverts for the requirements on vertical construction joints, apron and cutoff walls, longitudinal construction joints, and optional construction joints.

Name Plates are to be located by the Engineer in the field.

C. Miscellaneous Structures

Detail plans for other structures such as retaining walls, sign bridges, pedestrian bridges, and erosion control structures are to be detailed with the same requirements as previously mentioned.

D. Standard Drawings

Standard drawings are maintained and furnished by the Structures Development Section. These drawings show the common types of details required on the contract plans.

E. Insert Sheets

These sheets are maintained by the Structures Development Section and are used in the contract plans to show standard details.

F. Change Orders and Maintenance Work

These plans are drawn on full size sheets.

G. Bench Marks

Bench mark caps are shown on all bridges and larger culverts. Locate the caps on a horizontal surface flush with the concrete. Show the location in close proximity to the Name Plate.

(4) Checking Plans

Upon completion of the design and drafting of plans for a structure, the final plans are usually checked by one person. Dividing plans checking between two or more Checkers for any one structure leads to errors many times. The plans are checked for compliance with the approved preliminary drawing, design, sufficiency and accuracy of details, dimensions, elevations, and quantities. Generally the information shown on the preliminary plan is to be used on the final plans. Revisions may be made to footing sizes and elevations, pile lengths, dimensions, girder spacing, column shapes, and other details not determined at the preliminary stage. Any major changes from the preliminary plan are to be approved by the Chief Bridge Design Engineer.

Give special attention to unique details and unusual construction problems. Take nothing for granted on the plans.

The Checkers check the final plans against the Engineer's design and sketches to be sure all information is shown correctly. The Engineer prepares all sketches and notations not covered by standard drawings. A good Checker checks what is shown and noted on the plan and also checks to see if any essential details, dimensions, or notation have been omitted. Check the final plan Bid Items for conformity with those scheduled in the WisDOT Standard Specifications for Highway and Structure Construction.

The Checker makes an independent Bill of Bars list to be sure the detailer has not omitted any bars when checking the quantity of bar steel.

Avoid making minor revisions in details or dimensions that have very little effect on cost, appearance, or adequacy of the completed structure. Check grade and bridge seat elevations and all dimensions to the required tolerances. The Checkers make all corrections, revisions, and notations on a print of the plan and return it to the Plan Preparer. The Plan Preparer back checks all marks made by the checker before changing. Any disagreements are resolved with the supervisor.

Common complaints received from field people are dimension errors, small details crowded on a drawing, lettering is too small, and reinforcing bar length or quantity errors.

After the plans are completed, the items in the survey folder are separated into

the following groups by the Structures Design Unit Supervisor or plans checker:

A. Items to be Destroyed When Construction is Completed

1. Miscellaneous correspondence and Transmittal letters.
2. Preliminary drawings and computations.
3. Prints of soil borings and plan profile sheets.
4. Quantity computations and bill of bars.
* 5. Shop steel quantity computations.
6. Design checker's computations.
7. Designer Computations and computer runs of non-complex structures on non state maintained structures.
8. Layout sheets.
9. Elevation runs and bridge geometrics.
* 10. Falsework plans.
11. Miscellaneous Test Report
12. Photographs of Bridge Rehabs.

* These items are added to the packet during construction.

B. Items to be Destroyed when Plans are Completed

1. All "void" material.
2. All copies except one of preliminary drawings.
3. Extra copies of plan and profile sheets.
4. Preliminary computer design runs.

Items in Group A should be placed together and labeled. Items in Group B should be discarded.

The following items are part of the Data Management System for Structures. The location is shown for all items that need to be completed in order to properly manage the Structure data either by Structures Design personnel for in-house projects or consultants for their designs. Data for filing that is generated outside the Bureau of Structures should be sent to the Structures Development Section.

1. Structure Inventory Form (Available on DOTNET) - New Bridge File – Data for this form is completed by the preliminary designer and plans checker. It is submitted to the Structures Development Section for entry into the File.

2. Load Rating Input File - Permits File - The designers submit an electronic copy of the input data for load rating the structure to the Structures Development Section. It is located for internal use at //H32751/rating.

* 3. Designer Computations and Inventory Superstructure Design Run (Substructure

computer runs as determined by the Engineer) - **Bridgeview – The designers record design, inventory, operating ratings and maximum vehicle weights on the plans and place into the scanned folder.

4. Pile Driving Reports - Bridgeview - Structures Development Section scans reports into Bridgeview.

5. Shop Drawings for Steel Bridges, Sign Bridges, Prestressed Girders, High Mast Poles, Retaining Walls, Floor Drains, Railings and all Steel Joints - Bridgeview - Metals Fabrication & Inspection Unit or other source sends to the Structures Development Section to scan all data into Bridgeview.

6. Mill Tests, Heat Numbers and Shop Inspection Reports for all Steel Main Members - Bridgeview - Metals Fabrication & Inspection Unit sends electronic files data into Bridgeview.

7. Hydraulic and Scour Computations, Contour Maps and Site Report - Bridgeview - Data is placed into scanned folder by Preliminary Structures & Hydraulics Unit.

* 8. Subsurface Exploration Report - Bridgeview - Report is placed into scanned folder by Preliminary Structures & Hydraulics Unit or electronic copies are loaded from Geotechnical files.

* 9. Structure Survey Report - Bridgeview - Report is placed into scanned folder by Preliminary Structures & Hydraulics Unit.

10. As Built Plans - Bridgeview - At bid letting, the printers place a digital image of plans in a computer folder and send to the Structures Development Section where the plan sheets are labeled and placed in Bridgeview. As Built plans will replace bid letting plans when available and will be scanned by the Structures Development Section.

11. Inspection Reports - New Bridge File - The Structures Maintenance Section loads a copy of the following Inspection Reports into the New Bridge File.

A. Initial
B. Routine Visual
C. Fracture Critical
D. In-Depth
E. Underwater (UW)-Dive
F. Underwater (UW)-Surv
G. Underwater (UW-Probe/Visual
H. Movable
I. Damage
J. Interim
K. Posted

These items are placed into a Scanned Folder and loaded into Bridgeview by the Structures Development Section when construction is complete.

** Bridgeview – The electronic file where bridge data is stored for future use.

(5) Processing Plans

A. Before P.S. & E. Process

1. File plans in plan drawers by county for consultant work, or
2. Maintain plans as PDF on E-plan server.

B. At P.S. & E. Processing

1. Prepare plans for bid letting process.

C. After Structure Construction

1. Any data in Design Folder is scanned and placed with bridge plans.
2. Original plan sheets and Design Folders are discarded.

6.4 COMPUTATION OF QUANTITIES

When the final drafting and checking is completed, the Engineering Specialist and checker are to prepare individual quantity calculations for the bid items listed on the plans. The following instructions apply to the computation on quantities.

Be neat and orderly with the work. Divide the work into units that are repetitive such as footings, columns, and girders. Label all items with a clear description. Use sketches for clarity. These computations may be examined by others in future years so make them understandable.

One of the most common errors made in quantity computation is computing only half of an item which is symmetrical about a centerline and forgetting to double the result.

Staged Construction - On projects where there is staged construction that will involve two construction seasons the following quantities should be split to match the staging to aid the contractor/fabricator: Concrete Masonry, Bar Steel Reinforcement, Structural Steel and Bar Couplers. The other items are not significant enough to justify separating.

Following is a list of commonly used bridge quantities. Be sure to use the appropriate item and avoid using incidental items as this is too confusing for the contractor and project manager.

(1) Excavation for Structures Bridges (Structure)

This is a lump sum bid item. The limits of excavation are shown in the chapter in the manual which pertains to the structural item, abutments, piers, retaining walls, box culverts, etc.

The limits of excavation made into solid rock are the neat line of the footing.

(2) Backfill Granular or Backfill Structure

Backfill Granular and Backfill Structure are bid in units of cubic yard. The pay limits and quantity computations of backfill at abutments are shown in Chapter 12.

(3) Concrete Masonry Bridges

Show the total quantity to the nearest cubic yard. Show unit quantities to the nearest 0.1 cubic yard adjusted so the total of the unit quantities equals the total quantity. In computing quantities no deduction is made for metal reinforcement, floor drains, conduits and chamfers less than 2". Flanges of steel and prestressed girders projecting into the slab are deducted.

Deduct the volume of pile heads into footings and through seals for all piling except steel H sections. Deduct the actual volume displaced for precast concrete

and cast-in-place concrete piling. Deduct 0.02 cubic yard for each 14" of timber piles.

Consider the concrete parapet railing on abutment wing walls as part of the concrete volume of the abutment.

(4) Prestressed Girder Type I (28-Inch; 36-Inch; 45-Inch; 54W-Inch; 72W-Inch)

Record one type and length of prestressed girders to the nearest 3".

(5) Bar Steel Reinforcement HS Bridges or Bar Steel Reinforcement HS Coated Bridges

Record this quantity to the nearest 10 lbs. Designate if bar steel is coated and/or high strength. Include the bar steel in C.I.P. concrete piling in bar steel quantities.

(6) Structural Steel Carbon or Structural Steel HS or Castings Steel or Forgings Steel Carbon or Lubricated Plates Bronze or Sheet Copper or Sheet Zinc

In computing the weights of rolled shapes or plates make no deductions for cuts, copes, open holes, bevels, etc. If a length of rolled section is cut, compute the weight of the piece before the cut is made. Make no allowance for the weight of paint or weld metal. Record the quantity of Structural Steel Carbon, Structural Steel HS, Castings Steel, and Forgings Steel Carbon to the nearest 10 lbs. for quantities up to 10,000 lbs.. Record the quantity to the nearest 100 lbs. for quantities above 10,000 lbs.. Record the quantity of Lubricated Plates Bronze, Sheet Copper and Sheet Zinc to the nearest pound.

Include the weight of heads, nuts, single washers and threaded stick through of high strength bolts in the quantities. The following weights are to be used for this purpose:

Size Bolt	Weight in lbs./100 Bolts
3/4"	52.4
7/8"	80.4
1"	116.7

Compute the weight of castings based on their dimensions. Add 3 percent to allow for fillets and overruns.

(7) Bearing Pads Elastomeric Non-Laminated or Bearing Pads Elastomeric Laminated or Bearing Assemblies Fixed (Structure) or Bearing Assemblies Expansion (Structure)

Record as separate item with quantity required. Bid as Each.

(8) Piling Test Treated Timber (Structure)

Record this quantity as a lump sum item. Estimate the pile lengths by Examining the subsurface exploration sheet and the Site Investigation Report. Give the length and location of test piles in a footnote. Do not use this quantity for steel piling or concrete cast-in-place piling.

(9) Piling CIP Concrete Delivered and Driven -Inch
Piling Steel Delivered and Driven -Inch

Record this quantity in feet for Steel and C.I.P. types of piling delivered and driven. Timber piling are Bid as separate items, delivered and driven. Pile lengths are computed to the nearest 1.0 foot.

The length of foundation piling driven includes the length through any seal and embedment into the footing. The quantity delivered is the same as quantity driven. For trestle piling the amount of piling driven is the penetration below ground surface.

Oil field pipe is allowed as an alternate on all plans unless a note is added in the General Notes stating it is not allowed on that specific project.

(10) Preboring CIP Concrete Piling

Record the type and quantity in feet.

(11) Railing Steel Type (Structure) or Railing Tubular Type (Structure)

Record the type, quantity is a Lump Sum.

(12) Slope Paving Concrete or Slope Paving Crushed Aggregate or Slope Paving Select Crushed Material

Record this quantity to the nearest square yard. Deduct the area occupied by columns or other elements of substructure units.

(13) Riprap Medium, Riprap Heavy or Grouted Riprap
Record this quantity to the nearest 5 cubic yards.

(14) Pile Points

When recommended in soils report. Bid as each.

(15) Floordrains Type GC or Floordrains Type H
Record the type and number of drains. Bid as Each.

(16) Cofferdams (Structure)

Lump Sum

(17) Rubberized Membrane Waterproofing

Record the quantity to the nearest square yard.

(18) Expansion Device (Structure)

Record this quantity in lump sum. Show the distance between curb lines on structures with complex geometry to assist fabrication.

(19) Electrical Work

Refer to Standard Construction Specifications for bid items.

(20) Conduit Rigid Metallic -Inch or Conduit Rigid Nonmetallic Schedule 40 -Inch

Record this quantity in feet (meters) for Metallic Conduit (Size); Nonmetallic Conduit (Type and Size) or Conduit Special (Size).

(21) Protective Surface Treatment

Record quantity to the nearest square yard.

(22) Preparation Decks Type 1 or Preparation Decks Type 2

Estimate Type 2 Deck Preparation as 40% of Type 1 Deck Preparation. Record this quantity to the nearest square yard. Use 2" for depth of each Preparation, compute concrete quantity and add to Concrete Masonry Overlay Decks.

(23) Cleaning Decks

Record this quantity to the nearest square yard.

(24) Joint Repair

Record this quantity to the nearest square yard.

(25) Concrete Surface Repair

Record this quantity to the nearest square foot.

(26) Full-Depth Deck Repair

Record this quantity to the nearest square yard.

(27) Concrete Masonry Overlay Decks

Record this quantity to the nearest cubic yard. Estimate the quantity by using a thickness measured from the existing ground concrete surface to the plan gradeline. Usually 1" of deck surface is removed by grinding.

(28) Removing Old Structure STA. XX + XX.XX

Covers the entire or partial removal of an existing structure. Bid as Lump Sum.

(29) Anchor Assemblies for Steel Plate Beam Guard

Attachment assembly for Beam Guard at the termination of concrete parapets. Bid as each.

(30) Steel Diaphragms (Structure)

In span diaphragms used on bridges with prestressed girders. Bid as each.

(31) Welded Stud Shear Connectors X -Inch

Total number of shear connectors with the given diameter. Bid as each.

(32) Concrete Masonry Seal

Seal concrete bid to the nearest cubic yard. Whenever a concrete seal is shown on the plans, then "Cofferdams (Structure No.)" is also to be a bid item.

(33) Geotextile Fabric Type

List type of fabric. Type HR is used in conjunction with Heavy Riprap. Bid in square yards.

(34) Masonry Anchors Type L No. Bars

Used when anchoring reinforcing bars into concrete. Bid as each.

(35) Piling Steel Sheet Permanent Delivered or Piling Steel Sheet Permanent Driven

Record this quantity to the nearest square foot for the area of wall below cutoff.

(36) Piling Steel Sheet Temporary

This quantity is used when the designer determines that retention of earth is

necessary during excavation and soil forces require the design of steel sheet piling.

Record this quantity to the nearest square foot for the area below the retained grade and one foot above the retained grade.

| Following is a list of commonly used STSP's and Bureau of Structures Special Provisions.

| (37) Temporary Shoring

This quantity is used when earth retention may be required and the method chosen is the contractors option.

Bid as square foot of exposed surface as shown on the plans.

| (38) Concrete Masonry Deck Patching

(Deck preparation area's) x 2" deck thickness.

| (39) Sawing Pavement Deck Preparation Areas

Use 10 lineal feet per S.Y. of Preparation Decks.

| (40) Removing Bearings

Used to remove existing bearings for replacement with new expansion or fixed bearing assemblies. Bid as each.

6.5 PRODUCTION OF BRIDGE PLANS BY CONSULTANTS, REGIONAL OFFICES AND OTHER AGENCIES

The need for structures is determined during the Preliminary Site Survey and recorded in the Concept Definition or Work Study Report. On Federal (FHWA) or State Aid Projects completed Structure Survey Reports and plans are submitted to the Structures Design Section with a copy forwarded to the Regional Office for approval prior to construction. Structure and project numbers are assigned by the Regional Offices. In preparation of the structural plans, the appropriate specifications and details recommended by the Structures Design Section are to be used. If the consultant elects to modify or use details other than recommended, approval is required prior to their incorporation into the final plans.

On all Federal or State Aid Projects involving Maintenance work, the Concept Definition or Work Study Report, the preliminary and final bridge reconstruction plans shall be submitted to the Structures Design Section for review.

(1) Approvals, Distribution, and Work Flow

Consultant	1.	Meet with Regional Office and/or local units of government to determine need.
	2.	Prepare Structure Survey Report including recommendation of structure type.
Geotechnical Consultant	3.	Make site investigation and prepare Site Investigation Report.
Consultant	4.	Prepare Preliminary Plan documents including scour computations for spread footings and/or shallow pile foundations. Record scour critical code on preliminary plans. Refer to Chapter 8, Appendix 8-D.
	5.	Forward preliminary plans to the Structures Design Section for review and processing with a copy to the Regional Office.
Structures Design Section	6.	Record Bridge and project numbers.
	7.	Review hydraulics for Stream Crossings.
	8.	Review Preliminary Plan.
	9.	If a railroad is involved, send copies of preliminary plans to the Railroad.

	10.	If navigable waterway is crossed, a permit drawing to construct bridge is sent to Coast Guard. If Federal aid is involved preliminary plans are sent to Federal Highway Administration for approval.
	11.	Return preliminary plans and comments from Structures Design Section and other appropriate agencies to Consultant with a copy to the Regional Office.
	12.	Forward Preliminary Plan and Hydraulic Data to DNR.
Consultant	13.	Modify preliminary plan as required.
	14.	Prepare and complete final design and plans for the specified structure.
	15.	Write unusual special provisions.
	16.	Send copies of final plans and special provisions to the Structures Design Section.
Structures Design Section	17.	Review final plans.
	18	If a railroad is involved, send copies of final plans to Rails & Harbors Section.
	19.	Return comments to Consultant with copy to Regional Office.
Consultant	20.	Modify final plans and specifications as required.
	21.	Send final plan originals to Structures Design Section.
	22.	Send applicable Structure Inventory Data form to Structures Design Section. These forms are available on DTID Network.
Structures Design Section	23.	Review final plan originals.
	24.	Sign final originals.
	25.	Write standard Special Provisions and send

			plan originals to Bureau of Project Development.
	Bureau of Project Development	26.	Prepare final approved bridge plans for pre-contract administration.

(2) Preliminary Plan Requirements

The Consultant prepares the Structure Survey Report for the improvement. Three types of Structure Survey Reports are available at the Regional Offices and listed in Section 6.2(1) of this Chapter. Preliminary layout requirements are given in Section 6.2(2). The Preliminary Plan exhibits are as follows:

1. Structure Survey Report.
2. Preliminary Drawings.
3. Log Borings shown on the Subsurface Exploration Drawing which must be submitted now and can be included with the Final Plans.
4. Evaluation Report of Borings with Values for End Bearing and/or Skin Friction.
5. Contour Map.
6. Typical Section for Roadway Approaches.
7. Plan and Profile of Approach Roadways.
8. Hydraulic Report (see Chapter 8.0) is required for Stream Crossing Structures.
9. County Map showing Location of New and/or Existing Structures.
10. Any other information or Drawings which may influence Location, Layout or Design of Structure.

The above information is also required for Box Culverts except that a separate preliminary drawing is usually not prepared unless the Box Culvert has large wings or other unique features.

The type of structure is usually determined by the local unit of government and the Regional Office. However, Bureau of Structures personnel review the structure type and may recommend that other types be considered. In this regard it is extremely important that preliminary designs be coordinated to avoid delays and unnecessary expense in plan preparation.

If the final approach roadways are unpaved, detail protective armor angles at the roadway ends of bridge decks/slabs as shown on Standard 28.1.

The distribution of Preliminary Plan exhibits in addition to those required by the Regional Office is as follows:

Structure Type	Bureau of Structures	DNR	FHWA
Stream Crossings	2	1	
Grade Separation	2		
Railroad Crossings	4 **		
Special Types, (lift, moveable, cost greater than $10,000,000	4	1 *	4

* Only for Stream Crossings
** Requires 4 copies for each railroad crossed

The Structures Design Section coordinates the internal review and outside agency review of plans and reports. The approved Preliminary Plans with revisions and/or recommendations are returned to the Consultant. The Preliminary Plan may be incorporated as the Final Plan lead sheet unless there is a change in structure type.

(3) Final Plan Requirements

The guidelines and requirements for Final Plan preparation are given in Section 6.3. The following exhibits are included as part of the Final Plans:

1. Final Drawings. If final drawings are produced using Computer Aided Design and Drafting, contact the Structures Design Section for additional guidelines and requirements.

   For all highway structures provide the maximum vehicle weight that can be safely carried based on the procedure and vehicle configuration provided in the Bridge Rating Chapter 45.0.

2. Design and Quantity Computations

3. Special Provisions covering unique items not in the Standard Specifications such as Electrical Equipment, New Proprietary Products, etc. (The Structures Design Section provides Special Provisions for regularly used items).

The distribution of Final Plan exhibits in addition to those required by the Regional Office is as follows:

Structure Type	Bureau of Structures	FHWA
Stream Crossings	2	
Grade Separations	2	
Railroad Crossings	2 **	
Special Types	2	4

** Requires 2 copies for each railroad crossed.

On Federal or State Aid projects the contracts are let and awarded by the Wisconsin Department of Transportation. Shop drawing review and fabrication inspection are generally done by the Metals Fabrication and Inspection Unit. However, in some cases the consultant may check the shop drawings and an outside agency may inspect the fabrication. The Consultant contract specifies the scope of the work to be performed by the Consultant. Construction supervision and final acceptance of the project are provided by the State.

(4) Design Aids & Specifications

The following items are available for assistance in the preparation of structure plans on the department extranet sites:

Bridge Manual
Highway Structures Information System (HSI)
English insert sheets
English standard details
English sign bridges
Posted bridge map
Standard bridge CADD files
Structure survey reports and check lists
Structure costs
Special Provisions
https://trust.dot.state.wi.us/extntgtwy/dtid_bos/extranet/structures/index.htm
Contact: penny.rollins@dot.state.wi.us, 608-266-5088
scott.becker@dot.state.wi.us, 608-266-5161

Paper Copies	Price*	Source
Bridge Manual Text	$100	Structures Dev.-Room 601, 608-267-3577
Bridge Manual Update Service	$70	Structures Dev.-Room 601, 608-267-3577

Facilities Development Manual
https://trust.dot.state.wi.us/extntgtwy/fdm/
Contact: mark.truby@dot.state.wi.us, 608-266-9349

Wisconsin Standard Specifications
Construction and Materials Manual
https://trust.dot.state.wi.us/extntgtwy/dtidcons/constnds/
Contact: michael.hall@dot.state.wi.us, 608-266-8461

Other web sites:

AASHTO Specifications	https://bookstore.transportation.org
AREMA Specification	http://www.arema.org

* Prices listed do not include Wisconsin Sales Tax (5%) and Dane County Sales Tax (1/2%) which must be added to in-state orders.

The distribution of Preliminary Plan exhibits in addition to those required by the District is as follows:

(5) Processing Consultant Prepared Bridge Plans

Person Establishing Consultant Packet

1. Place items received from Regional Office in Packet.
2. Items placed in manila folder

   A. Structure Survey Report
   B. Hydraulic computations

3. Give to Consultant Plan Checker

Consultant Plan Checker

1. Design Packet will be stored with Consultant data.
2. Items placed in manila folder are:

   A. Design Computations – State Maintained Bridges only OR Complex Bridge on Local System.
   B. Subsurface Report (Report may be on file but designers use this printed copy).
   C. Pile Driving Reports

3. All other material will be placed in Packet outside Folder.

PROCESS PACKET

Structures Development Section

1. At end of Calendar Year, list of Constructed Bridges will be published. (Could be March of following year).
2. Process items in Manila Folder into PDF file within the Project Electronic Folder. Verify scanning. Store in Bridgeview.
3. Discard all material in Project Packet. Recycle Packet.
4. Archive & Delete replaced bridge from Bridgeview.
5. Archive & Delete Rating folder for replaced bridge.
6. Create new Rating Folder for new Bridge.
7. If State maintained bridge, delete old bridge from Permit Rating File.
8. Discard plan sheets for new bridge located in Structures Design Section flat files.
9. On steel bridges verify shop plans are in Bridgeview.

PROCESSING CULVERTS

1. Change Year end run to determine completed Projects, include C, P, B & S numbers.
2. Process like bridge where required.
3. Delete old culvert card if replaced.

FUTURE CONSULTANT LOAD RATING

1. Provide access to Rating Programs on Extranet.

   A. Show Input screen
   B. Provide Help menu for Input
   C. Designate Folder location for Input screens